Read the article "The Enigma of the Echidna" before answering Numbers 1 through 7.

The Enigma of the Echidna

By Doug Stewart

Scientists are continually perplexed by this egg-laying Australian mammal's unpredictable behavior and strange physical characteristics.

One of the most remarkable sights that biologist Peggy Rismiller has seen in her years exploring the Australian bush is that of an echidna sunbathing. The short-beaked echidna, or spiny anteater, ordinarily resembles a spiky ball, like some kind of terrestrial sea urchin. To warm up on a cool morning, however, it will stretch out on the ground, its body flat, and lift its spines to let in sunlight. "It's amazing to see," Rismiller says. "It looks like a rug with spines."

On a continent teeming with weird mammals, the echidna is one of the weirdest. It has a beak like a bird, spines like a hedgehog, eggs like a reptile, the pouch of a marsupial and the life span of an elephant. Elusive and unpredictable, echidnas continue to perplex the scientific world with their oddities. "They're such an independent, enigmatic animal," says Rismiller. "Every time you think you know what they're going to do, they do something different."

"Echidna" commonly refers to the short-beaked echidna, which is found across Australia. A second genus, the long-beaked echidna, lives in Papua New Guinea.

The first detailed description of the echidna was published in England in 1792. A decade later, another account included a meticulous drawing by Captain William Bligh, who had feasted on roast echidna years earlier during a post-mutiny stopover in Australia. Bligh had the foresight to sketch the strange animal before eating it. Not until 1884 did the scientific world learn to its amazement that both platypuses and echidnas laid eggs.

Since then, Australians have adopted the short-beaked echidna as a national mascot of sorts. It's among the most widely, if sparsely, distributed of all Australian mammals—wandering and burrowing its way across rain forest, desert, bush, swamp and seashore. The echidna's

total numbers are unknown. "You can't do the usual mammalian trapping surveys because you can't trap them," says Rismiller. "Even food won't lure them." Concerned that their future welfare is not assured, Australia has officially listed them as a protected species. In her 15 years of living in a pristine area for wildlife not far from Adelaide, Rismiller has become the world's foremost authority on the short-beaked echidna. Rismiller and her partner, biologist Mike McKelvey, work at the rustic Pelican Lagoon Research and Wildlife Centre on South Australia's remote Kangaroo Island. The two operate the facility as a nonprofit educational trust that specializes in low-impact field research. It's the sort of place where computers are solar-powered and rain provides drinking water. Volunteers sweep bat guano from the tables each morning.

Rismiller works only with live, free-ranging animals, which is a challenge as echidnas are hard to find and harder to catch. When she arrived, she and her colleagues searched for 300 hours before encountering their first one. Small, dark, wary and virtually silent, an echidna in plain sight can resemble a low, nondescript bush. Rismiller now sees to it that a quarter of the four dozen echidnas roaming the Pelican Lagoon area of Kangaroo Island carry radio transmitters epoxied to a spine on their backs. (Traditional radio collars won't fit, echidnas being essentially neckless.) Still, tracking even radio-tagged echidnas isn't easy. "They're built low to the ground," says McKelvey, "and they spend a lot of time in burrows and caves, which block the signal." Moreover, a single spine can be a precarious attachment point. Says Rismiller, "I call one of the echidnas here our $10,000 male because he's shed so many transmitters." He may have learned to scrape them off between rocks.

Rismiller, who also studies tiger snakes, admits she's obsessed with echidnas. "They're such wonderful, attractive, enigmatic animals. They have a rolling, waddling gait. Their spines make them look formidable, but they're really quite gentle animals. To see their little beaks and their little eyes looking up at you, it's *Lord of the Rings*[1] all over. You think: 'Here is a wise little gnome.' "

Adult echidnas are roughly the size and weight of newborn humans, but helpless they're not. Their short legs, heavy, backward-pointing rear claws and broad shoulders are well-suited to powerful digging. Alone among mammals, echidnas can dig straight down, disappearing in minutes. Natural escape artists, echidnas can also dig through wooden garage doors and heavy plastic storage bins. Metal walls are a better deterrent, but they're not unbreachable, as researchers at the University of Melbourne discovered recently. A group of captive echidnas there were confined to a pen with corrugated-iron walls. "After three days," Rismiller says, "the researchers found the drinking bowls had been stacked in a corner, and all the echidnas had climbed out."

[1] ***Lord of the Rings*:** title of a fantasy trilogy by British author J.R.R. Tolkien (1892–1973)

While hatchlings have an egg tooth for breaking out of the shell, adults are utterly toothless. They use their hard, skin-covered beaks, an extension of the skull, to root around vegetation, plow through soil and pry up rocks in a search for ants, termites, worms, grubs and other food. The short-beaked echidna's scientific name, *Tachyglossus aculeatus*, is apt: fast-tongued and spiny. The animal slurps up prey with a long sticky tongue that darts in and out of its beak.

Aussies may refer to echidnas casually as "porkies," but their spines have little in common with a porcupine's quills. Echidna spines lack barbs and are never thrown from the body. What's more, a porcupine can't use its quills to climb a rock crevice or right itself when upended, as an echidna can. "Echidna spines are actually modified hairs," says Rismiller. "They have a long root that goes into a special muscle layer no other mammal has." The animals can thus move spines individually or in small groups—to protect their heads, for example. "When you pick one up, the spines on its head will stand up straight while those on its back will lay flat." This muscle control isn't always voluntary.

Rismiller suspects that spines may aid in the species' survival in an unexpected way. Like other mammals, echidnas are hairy and milk-bearing, but their blood is only lukewarm. An active echidna's innards usually range between 88 and 91.5 degrees F, or 31 to 33° C. (An inactive echidna can be much cooler; to conserve energy, it can go into torpor, letting its body drop to as low as a few degrees above freezing.) "Cold doesn't deter them," says Rismiller, "but if their body temperature rises above 33° Celsius [well below what's normal for humans] heat stress will kill them." Echidnas have no sweat pores, nor do they pant. Might their spines, so deeply embedded in well-vascularized tissue, be capable of dissipating excess heat? The idea for now is conjecture, but Rismiller hopes to pursue it.

Much about echidna behavior is a mystery. "It's because they're so difficult to study," she says. "They're hard to find, they're solitary, they make no noise and they travel great distances." Their wanderlust is one reason they're ill-suited to captivity. Attempts to relocate them inevitably fail; even after a 30-kilometer drive, says McKelvey, "the animal is back almost before the humans are." Echidnas have no routines. They're active day or night, regardless of weather. They lack permanent dens, choosing instead to sleep in whatever burrow or cave is handy. They don't socialize and they haven't been known to fight. They forage in a home territory as large as 250 acres yet don't defend it. They tend to ignore any creatures they encounter, except when the time comes to mate.

After a three-week gestation, the female lays a single soft leathery egg about the size of an American dime. The baby echidna, or puggle, hatches in ten and a half days and remains in the pouch to suckle.

Like a newborn kangaroo, the puggle is essentially a mobile embryo: Its extremities are transparent, its eyes and backbone unformed, its forepaws capable of grasping but its hind legs mere buds. In two weeks, the hatchling gains 100 times its birth weight, growing from a third of a gram to about 30 grams. At seven or eight weeks, when the puggle starts to grow spines, the mother evicts it from her pouch (understandably) and places it in a nursery burrow. Thereafter, she visits for feedings every five or six days. In about seven months, the juvenile has a full complement of spines and claws and is foraging on its own.

Thanks to its armored exterior, an adult echidna has few native predators. On Kangaroo Island it has none, though a large monitor lizard called Rosenberg's goanna preys on spineless burrow young. Introduced predators are a bigger threat. Feral cats attack burrowing young as well as torpid adults. On the mainland, predators include dogs, feral pigs, foxes and dingoes. The echidnas' customary defense is to roll into a ball. Outside conservation areas, habitat loss and fast-moving vehicles are perhaps the species' gravest threat, however. (An echidna spine can puncture a tire, but it's always after the animal has died.)

Those animals that evade mishaps compensate for their low-speed, slow-breeding life-style by often living 50 years or more. A Kangaroo Island local told Rismiller he had been watching the same full-grown echidna wander about his farm since he was a boy 45 years earlier. When she asked how he could be sure it was the same animal, he replied, "Easy. It only has three legs."

A final oddity about these very odd creatures: The echidna's neocortex, associated with reasoning and personality in humans, accounts for nearly half its brain's volume, compared to about 30 percent in so-called higher mammals. "What are they doing with it, that's the question," says Rismiller. "I think they're using it to play tricks on me, that's what I think. They use it to get rid of their transmitters."

"The Enigma of the Echidna" by Doug Stewart. Reprinted by permission of the author. Copyright © 1996–2003. Published in the *National Wildlife Federation*, Oct/Nov 2003. All rights reserved. "14 day old baby echidna (Puggle)": Reprinted by permission of Mike McKelvey, Photographer. All rights reserved. "Echidna": © Staffan Widstrand/CORBIS.

Now answer Numbers 1 through 7 on your Sample Answer Sheet on page 15. Base your answers on the article "The Enigma of the Echidna."

1 Read this excerpt from the article.

> **"They're such an independent, enigmatic animal," says Rismiller. "Every time you think you know what they're going to do, they do something different."**

In the excerpt, Rismiller is discussing

A. the echidnas' solitary habits, which make the animals difficult to locate.

B. the echidnas' instincts, which make the animals able to successfully avoid capture.

C. the unpredictable behavior of echidnas, which makes the animals puzzling subjects to study.

D. the mysterious nature of echidnas, which makes the animals difficult to classify appropriately.

2 Rismiller supports the idea of low-impact field research by

F. drinking rainwater and using solar energy.

G. employing volunteers and using metal pens.

H. tracking echidnas in their natural environment.

I. attaching transmitters to the spines of echidnas.

3 Which of the following is NOT a factor that makes tracking echidnas with radio transmitters challenging?

A. Echidnas spend time in caves.

B. Transmitters are difficult to attach.

C. Transmitters are difficult to acquire.

D. Echidnas are built low to the ground.

4 According to the article, what is one echidna characteristic that is shared with other mammals?

F. the production of milk
G. the size of the neocortex
H. the use of spines for climbing
I. the use of the beak for rooting

5 According to the article, the main similarity between echidnas and porcupines is their

A. special muscles.
B. physical appearance.
C. capacity to move their spines.
D. ability to use their quills to climb rocks.

6 The greatest danger to echidnas outside conservation areas is posed by

F. feral cats and dingoes.
G. monitor lizards and foxes.
H. introduced predators and scientific research.
I. decreased living space and human intrusion.

7 According to the information presented in the article, all of these factors account for the uncertainty in determining total echidna population in Australia EXCEPT

A. the failure of traditional trapping methods.
B. the difficulty of attaching radio transmitters.
C. the ruggedness of the terrain where echidnas dwell.
D. the distribution of echidnas throughout the continent.

Read the "Quest-4 Cell Phone—User Manual" before answering Numbers 8 through 12.

Quest-4 Cell Phone — User Manual

USING THE CALENDAR

The calendar in your Quest-4 cell phone is a convenient way to keep track of important reminders; tasks that need to be completed; people who must be called; and special events such as concerts, ball games, graduations, and vacations. Your Quest-4 cell phone will hold up to 300 calendar entries.

CALENDAR SYMBOLS

Calendar entries may be categorized into four types:

☑	**Reminders**	Study for an exam, prepare for a speech, pick up your child after school, etc.
☎	**Calls**	Cancel a doctor's appointment, make a restaurant reservation, renew library books, etc.
1	**Tasks**	Reset your smoke alarms, water the lawn, change the oil in your car, etc.
<	**Events**	Attend the school musical, your family reunion, the county fair, etc.

ADDING CALENDAR ENTRIES

From the main menu, choose *Calendar*. Press **OK**.

- From the calendar menu, use the **UP** and **DOWN** arrows to choose *New Entry*. Press **OK**.
- Choose *Category*. Press **OK**. Choose the icon that corresponds to the type of entry you want to make (*Reminders*, *Calls*, *Tasks*, or *Events*). Press **OK**.
- Enter a word or phrase that identifies your calendar entry (Track Meet, Piano Recital, etc.). Next, enter the date and time of the event.
- Choose *Ring Tone* or *Preset Melody* to remind you of this date. Press **OK**.
- If you would like an advance reminder, you can choose the number of minutes or hours prior to the event when you wish to be alerted. Press **SELECT** at the bottom right of the display. Your task or event is scheduled.

ACCESSING CALENDARS

From the main menu, choose *Calendar*. Press **OK**.
Choose *Week View* mode or *Month View* mode.

If you choose *Week View* mode, the current week will display. To choose a different week of the current month, choose *Change Week* at the bottom left of the display, and use the **RIGHT** and **LEFT** arrow keys to select 1, 2, 3, 4, or 5 (first week, second week, etc.). In *Week View* mode, the days are listed in a column, with an icon or icons next to days that have entries from your personal calendar. Clicking on the icon will display a screen with the details of that entry.

If you choose *Month View* mode, the display is similar to a calendar with columns and rows. The current month will display with the current day highlighted. The **RIGHT** and **LEFT** arrows allow you to move forward and backward through the days of each week. The **UP** and **DOWN** arrows allow you to move up and down to different weeks. Once the **DOWN** arrow has moved to the last week of the month, the next click of the **DOWN** arrow advances the display to the following month. After the **UP** arrow reaches the first week of the month, the next click of the **UP** arrow key changes the display to the preceding month. Dates with entries from your personal calendar are highlighted in blue. To obtain *Week View* mode when in *Month View* mode, simply highlight any day in the desired week and choose *Week* at the bottom left of the display.

DELETING CALENDAR ENTRIES

From the main menu, choose *Calendar*. Press **OK**.

- Choose *Month View*.
- Highlight the date of the entry to be deleted. Press **OK**.
- Select the entry to be deleted. Choose *Options* at the lower right of the display. Choose *Erase*. Press **OK**.
- To erase everything for an entire month, highlight the month name at the top of the display. Choose *Options* and then choose *Erase*. Press **OK**.
- To erase all entries, choose *Options* and then choose *Erase All*. Press **OK**.

MAKING EMERGENCY CALLS

Even if your Quest-4 cell phone is not activated, you can still use it to make an emergency call. Your Quest-4 phone supports the country-specific emergency numbers 112, 911, 999, and 08. Under normal circumstances, these numbers can be used to make an emergency call in any country that uses one of these emergency numbers.

To determine a local emergency number, choose *Phone Book* from the main menu. Press **OK**. Use the **UP** and **DOWN** arrow keys to scroll to *Special Numbers*. Press **OK**. Choose *SOS Numbers*. Press **OK**. A list of locations and corresponding emergency numbers displays.

ENHANCED EMERGENCY SERVICE (EES)

Your Quest-4 cell phone features an embedded Global Positioning System (GPS) chip. If you should experience an emergency in a location where a GPS signal is available, your phone will automatically seek information and report your approximate location when you make a call to an emergency number; however, it is important that you report your location as specifically as possible to the operator who handles your emergency call in case the area is not equipped to receive GPS information.

"Quest-4 Cell Phone—User Manual" property of the Florida Department of Education.

Now answer Numbers 8 through 12 on your Sample Answer Sheet on page 15. Base your answers on the "Quest-4 Cell Phone—User Manual."

8 Read this sentence from the user manual.

> **To obtain *Week View* mode when in *Month View* mode, simply highlight any day in the desired week and choose *Week* at the bottom left of the display.**

In which sentence does *mode* have the same meaning as in the sentence above?

F. She reacted to the change in the mode of the teacher's voice.
G. The instructor asked the students to find the mode of a set of numbers.
H. She switched the computer's application from keyboard to voice mode.
I. The subway is her favorite mode of transportation when she visits the city.

9 The *CALENDAR SYMBOLS* chart is different from the other text features in the user manual because it

A. lists events in order of importance.
B. illustrates how to input calendar dates.
C. provides a key for categories of calendar entries.
D. clarifies the operating instructions of the cell phone.

10 Whether the Enhanced Emergency Service will be fully functional is mainly dependent upon the user

F. having paid for the embedded option.
G. reporting his or her location accurately.
H. knowing how to operate GPS technology.
I. being in a location where a GPS signal is available.

11 The four symbols explained in the user manual can best be described as

A. effects.
B. labels.
C. locations.
D. switches.

12 Which of the following is NOT true of the Quest-4 cell phone?

F. Some emergency numbers can be found through a menu.
G. The calendar will store an entry for every day of the year.
H. All entries in the calendar year may be deleted at one time.
I. Users may choose to be alerted of a deadline by a ring tone.

Read the article "The Height of Ingenuity" before answering Numbers 13 through 16.

The Height of Ingenuity

by NORMAN VANAMEE

One of the less glamorous tasks builders face is designing things that people don't want to have around—electrical substations, tunnel exhaust vents, sewage treatment plants. Or cell phone antennas, one of the most difficult design challenges of contemporary life. Since the mid-1980s, almost 150,000 of these unlovely radio transmitters have sprung up around the country on poles along roadways and on the façades of buildings. The construction of new antennas grows at a steady rate of 12 percent a year; meanwhile, communities have become even less willing to have them placed on their streets and in their backyards.

Historically, there have been two basic approaches to designing objects people find unattractive, says Howard Decker, chief curator of the National Building Museum. "The most obvious way is to hide them or make them look as if they are something else," he says. Recent examples of this tactic are the pine-tree-shaped cell phone towers located on the Garden State Parkway in New Jersey. The other is not to hide the object at all but to fashion it into a work of art. "I find the pine-tree towers absurd," says Peter Reed, curator of architecture and design at the Museum of Modern Art. "Why not just make it a really beautiful design?" Both approaches were on display last month at the Tower Summit and Trade Show in Las Vegas, an annual convention for the wireless industry. Below are the finalists in the cell phone tower "most creative site concealment" contest.

First Place

Voyager, Fayetteville, North Carolina

Tom Grubb: "I am an artist with a background in engineering. I had been commissioned to do a piece in Fayetteville for the 100-year anniversary of flight. Around the same time, a cell phone company made an application to build a tower in a location that was in the sightline where my sculpture was supposed to go. So I went to the cell phone company with a proposal to turn the tower into a sculpture. They were talking about how to hide it, and I was saying, 'Let's look at the tower as a piece of art.' It's made out of aluminum, stainless steel and bronze cable. It weighs 1,500 pounds and is perfectly balanced on top of the pole. A wind of one mile per hour can move it. It was very important that I add very little lateral stress to the tower and also that the sculpture did not interfere with transmissions. I did the installation in front of an audience. It's an art piece that just happens to transmit telephone signals."

Sprint Voyager

Runner-Up

Saguaro Cactus, Fountain Hills, Arizona

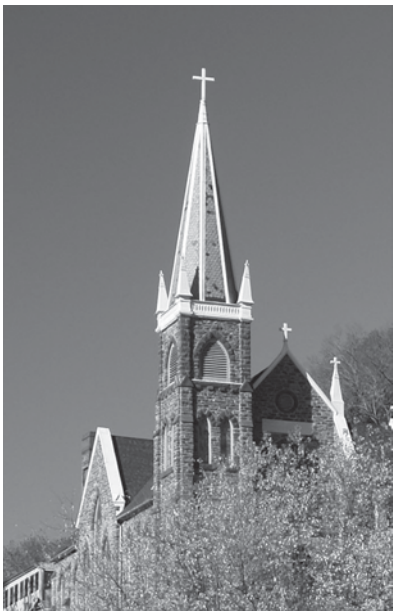
Steve Meyer, camouflage division manager, the Larson Company: "Our company builds themed environments for places like zoos and amusement parks, but we also disguise infrastructure. Zoning officials have kind of upped the ante in the level of realism they want to see. We call what we did with the cactus 'invisible' or '100 percent concealment.' It's 30 feet tall and made of fiberglass. With the pine trees, the antennas are placed outside the pole and are only partially disguised by the branches, but with the cactus, the antennas are actually hidden in the trunk."

Saguaro Cactus

Runner-Up

Church [Spires], Harpers Ferry, West Virginia

Jon Mitchell, national sales director: "The church was going through a renovation, and we were able to work with the diocese to place antennas inside the spires. They required that we do exact reproductions, so we removed one of the spires and shipped it to the West Coast and made a mold from it. There are three antennas and one Global Positioning System device located in the four spires surrounding the main steeple. We've built many antennas in churches before. The restrictions vary."



Church in Harpers Ferry, West Virginia

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Now answer Numbers 13 through 16 on your Sample Answer Sheet on page 15. Base your answers on the article "The Height of Ingenuity."

13 From reading the article, the reader can conclude that the work of designing unwanted structures is

A. difficult and unrewarding.
B. creatively challenging.
C. easily accomplished.
D. dull and unexciting.

14 According to the article, Grubb first became interested in turning a cell phone tower into a piece of art when he

F. accepted a commission for a design honoring flight.
G. realized a tower would make an attractive sculpture.
H. heard about an award being offered for creative design.
I. learned of a tower planned near his proposed sculpture.

15 According to the article, what was one of Grubb's main concerns when creating his sculpture?

A. the use of bronze cable
B. the symmetry of the tower
C. the presence of an audience
D. the avoidance of signal interference

16 The contest entries from Steve Meyer and Jon Mitchell are similar in all the following ways EXCEPT

F. the use of concealed antennas.
G. the need for creative planning.
H. the use of aluminum exteriors.
I. the need to address expectations.

Name _____

Answer all the Reading Sample Questions on this Sample Answer Sheet.

1	Ⓐ	Ⓑ	Ⓒ	Ⓓ	8	Ⓕ	Ⓖ	Ⓗ	Ⓘ	15	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2	Ⓕ	Ⓖ	Ⓗ	Ⓘ	9	Ⓐ	Ⓑ	Ⓒ	Ⓓ	16	Ⓕ	Ⓖ	Ⓗ	Ⓘ
3	Ⓐ	Ⓑ	Ⓒ	Ⓓ	10	Ⓕ	Ⓖ	Ⓗ	Ⓘ					
4	Ⓕ	Ⓖ	Ⓗ	Ⓘ	11	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
5	Ⓐ	Ⓑ	Ⓒ	Ⓓ	12	Ⓕ	Ⓖ	Ⓗ	Ⓘ					
6	Ⓕ	Ⓖ	Ⓗ	Ⓘ	13	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
7	Ⓐ	Ⓑ	Ⓒ	Ⓓ	14	Ⓕ	Ⓖ	Ⓗ	Ⓘ					